Lessons Learned from Implementing Technology in an Undergraduate Elementary Education Program

Shelley B. Wepner, Kathleen A. Bowes, and Rita Serotkin

Abstract

This article describes the implementation of a state-funded grant, the challenges that emerged, and the lessons learned. This yearlong grant, Technology³, provided the resources for university faculty, teacher candidates, and cooperating teachers to integrate technology. Findings from the grant did not indicate significant changes in perceived abilities and attitude, but did indicate changes in increased uses of technology. Issues with implementing the grant involved faculty reluctance and lack of technology prowess, uneven technology skills and technical support at the Professional Development School, unprepared teacher candidates, an overworked Technology Learning Specialist, and problems with hardware and software. Four lessons learned were the importance of: effecting change with faculty, being specific about project requirements, assessing teacher candidate technology competencies, and crafting clear job descriptions.

Melissa is a bilingual student whose parents are Cuban immigrants. Prior to student teaching, Melissa's technology background was limited to basic word processing skills. She initially depended on this skill to have students use technology to create their own biographies, creative writing stories, "how to" reports, writing templates, and insect books. During student teaching, Melissa learned desktop publishing and how to demonstrate it on a computer projection system so that she could model for students how to publish their writing. She learned how to use Inspiration so that she could teach her students how to construct concept maps and graphic organizers for math and science concepts. She learned how to develop Web-based lessons so that her students could work with online math games and take geography landform virtual tours.

Melissa explored creative uses for digital still and video cameras to enhance writing assignments and document projects and field trips. She used video to record how students worked together on projects. Gradually, she taught her students how to do desktop video editing with iMovie to edit videoclips of, for example, the life cycle of a butterfly. To capture her teaching experiences throughout college, Melissa created a Web-based electronic portfolio. Through text, images, and video, she was able to communicate her different field experiences, her educational philosophy, and her self-reflections.

* * *

As one of seven participating student teachers in a state-funded grant, Melissa represents what a student can do with technology. Although Melissa began student teaching with very few technology competencies, she took advantage of the resources and opportunities provided. But it was not easy. She had to learn how to use technology as she learned how to succeed as a student teacher. She also had to navigate issues with her cooperating teacher and university supervisor as they grappled with their own technology-based insecurities. Even when funds are available for technology, institutions still struggle with implementation issues related to faculty resistance and inexperience, lack of student competencies, and lack of technical and instructional support.

Background of Grant

We discovered these challenges when we implemented a Link-to-Learn grant funded by the Pennsylvania Department of Education that was established to help colleges and universities integrate technology into their teacher education programs. Our program, Technology³, addressed the needs of three groups of stakeholders in the teacher education process—university faculty who teach required instructional methods courses in key content areas and supervise student teachers, cooperating teachers who mentor student teachers, and the teacher candidates themselves—with three essential technology components—hardware, software, and technology learning support—through a three-pronged approach based on training, modeling, and mentoring.

The project set out to establish an integrated program of instruction and professional development to ensure that: (1) teacher educators—including faculty, university supervisors, and cooperating teachers—had the necessary competencies to train, model, and mentor students in the effective use of technology; and (2) undergraduate students eligible for elementary and early childhood education certification would develop competencies for integrating technology into the curriculum. Highlights of initiatives included:

- Placement of two wireless labs in Widener University's K–5 Professional Development School (PDS) for teacher candidate and cooperating teacher use
- Creation of a staffed Instructional Technology Lab at the university with "open lab hours" to provide access to hardware, software, and peripherals, and
- Provision of technology training, follow-up workshops, and mentoring by a Technology Learning Specialist for all stakeholders during the fall and spring semesters

Faculty who participated were to revise key content area methods courses to include technology. University supervisors were to evaluate and advise student teachers on the effective use of technology. Cooperating teachers were to integrate technology into their own class instruction and mentor student teachers in doing the same. Teacher candidates themselves were to create and implement technology-infused lesson plans.

We evaluated the effectiveness of this grant by looking at pre- and post- self-assessments and evaluative reports of the teacher candidates, the faculty, and the cooperating teachers, and by studying the teacher candidates' use of technology in student teaching as reflected in student teachers' electronic portfolios. The student teachers' eight technology-based lesson plans were evaluated for the type of technology used for each content area.

Technology Training in Teacher Education Programs

We sought funds for this yearlong project to acquire the resources needed to encourage faculty and students to use technology, and to get the external recognition to communicate the importance of this pursuit to our faculty and administration. More often than not, lip service is given to integrating technology into the curriculum. Few university faculty have the necessary competencies for truly integrating technology into their coursework (Wepner, Tao, & Ziomek, 2003).

As the research indicates, technology integration in teacher education programs presents a challenge to teacher educators (Johnson-Gentile, Lonberger, Parana, & West, 2000; Lan, 2001; Marcovitz, 1999; McCoy, 2000; Milbraith & Kinzie, 2000; Morrow, Barnhart, & Rooyakkers, 2002; Ross & Wissman, 2001; Sheehy, 2001; Suleiman, 2001; Wepner, Tao, & Ziomek, 2004; Young, 2002). Nevertheless, faculty use of technology promotes teacher candidates' use of technology (Handler, 1993; Marra, Howland, Wedman, & Diggs; 2003; Vannatta & Beyerbach, 2000; Yildrim, 2000; Zehr, 1997). When teacher candidates have their own feelings of self-efficacy in using technology, they are more likely to use it in their teaching (Anderson & Petch-Hogan, 2001; Brush et al., 2003; Dawson & Norris, 2000; Pope, Hare, & Howard, 2002; Wang, 2002). Teacher candidates' use of technology in the classroom needs to be supported and reinforced by their cooperating teachers and university supervisors (Dawson & Norris, 2000; Ryan, Onarheim, & Anderson, 2001; Strudler & Wetzel, 1999; Zambo, Buss, & Wetzel, 2001). Thus, all three stakeholders need to be part of a university's efforts to promote technology in teaching. Neglecting any one of the three groups undermines the entire process.

Training, modeling and mentoring need to be part of a teacher education program so that university faculty, teacher candidates, and cooperating teachers have the necessary knowledge base and comfort level to integrate technology into their teaching practice. Although various professional development models exist that address one or two of the previously mentioned stakeholders, we are not aware of research that addresses all three stakeholders within a training, modeling, and mentoring framework. Our project attempted to determine whether our model was feasible for teacher education programs.

For purposes of this grant, we define training as whole-class, small group, or individual instruction in end-user applications such as educational software, the Internet, and the design and use of multimedia. We define modeling as a form of instruction where someone with expertise demonstrates to someone with less expertise how to use a specific technology application for a specific instructional purpose. Modeling has been proven to be a highly effective technique for helping preservice teachers use technology (Faison, 1996; Kovalchick, 1997; Nicaise & Barnes, 1996). We define mentoring as a form of instruction where there is an ongoing relationship between an experienced and a less experienced person in which the mentor provides guidance, advice, support, and feedback to the protégé (Haney, 1997).

Description of Implementation of the Grant

Technology Learning Specialist Responsibilities

A full-time Technology Learning Specialist (TLS) was hired to serve as a trainer, modeler, and mentor for the faculty, cooperating teachers, and teacher candidates. Before the faculty and teacher candidates returned from the summer, he set up all the hardware that was made available through the grant, including two wireless labs for the elementary school. He conducted a needs assessment to determine the skills and attitudes of all stakeholders and develop their individual Professional Improvement Plans (PIPs).

The TLS began training the faculty during the fall semester by offering workshops on topics such as Web page development, specific software applications, Internet searching, and multimedia development. When invited, he went into their classrooms to model ways in which to use specific technology applications that had been discussed and demonstrated during the workshops. The TLS mentored faculty by working with them one on one or by going into their classrooms to assist them when they were trying a new form of technology. At the same time, he worked with the teacher candidates by providing workshops on topics assigned by the methodology teachers, and mentored teacher candidates on various technology applications and assigned projects.

As the grant progressed, the TLS worked more intensely with the student teachers by offering workshops, modeling specific techniques in the university's lab, and going into their elementary school classrooms to mentor them. He also worked with the university supervisors and the cooperating teachers: supervisors attended the same workshops as the student teachers, and the cooperating teachers attended mini-workshops in their building, which were supplemented by in-class technical support that he also provided.

Stakeholder Responsibilities

The four methodology teachers were selected because they teach the basic discipline-specific content courses (reading/language arts, mathematics, science, and social studies) in the undergraduate elementary education program. They were responsible for revamping their syllabi to include technology in their lessons and their assignments, which could vary from having teacher candidates evaluate software and Web sites to including technology in lesson plans. The teacher candidates would have to complete a checklist of technology requirements from both the methodology courses and student teaching. During student teaching, they had to teach with technology a minimum of eight times across the four content areas. They also had to complete an electronic portfolio that was to be evaluated by the university supervisors. The university supervisors assigned to the student teachers had to be able to evaluate their use of technology, and the cooperating teachers had to be able to work alongside them to assist and evaluate their use of technology.

Findings from Data Collected

We used pre- and post- self-assessments and evaluative reports of the teacher candidates, the faculty, and the cooperating teachers to see if there were changes in self-perceptions of their skill levels before and after the grant. We used the student teachers' technology-based lesson plans to assess whether, in fact, they actually used technology for teaching.

Pre- and Post- Self-Assessments

The pre- and post-test instrument used to evaluate the perceived skills of two groups of stakeholders (faculty and cooperating teachers) was the Mankato Scale (Johnson, 1999). This instrument measures practicing teachers' self-perceptions of the level of their technology proficiency. There are four skill levels: pre-awareness, awareness, mastery, and advanced, in each of 16 technology categories. Teachers select the level that best describes their current state of achievement.

The pre- and post-test instrument used to evaluate the attitudes of the teacher candidates was the Computer Attitudinal Questionnaire (CAQ) (Knezek & Christensen, 1998). Teacher candidates were asked to respond to 72 items of this 80-item, five-point Likert-type self-report questionnaire.

Faculty. Seven faculty (the four methodology teachers and the three university supervisors) completed the Mankato Scale prior to implementing the grant and at the completion of the grant period. Table 1 shows the total number of responses at each level.

Table 1. Analysis of the Pre and Post Mankato Scale Assessments for Faculty

	Pre-Awareness	Awareness	Mastery	Advanced
Pre-Assessment	32	39	37	4
Post-Assessment	26	34	34	18

The post-assessment scores indicate a decrease in the number of responses at the pre-awareness level and an increase in the number of responses at the advanced level. Overall, the data showed that the faculty moved away from the pre-awareness level and toward the advanced level.

Cooperating Teachers. Seven cooperating teachers completed the Mankato Scale prior to implementing the grant and at the completion of the grant period. Table 2 shows the total number of responses at each level.

Table 2. Analysis of the Pre and Post Mankato Scale Assessments for Cooperating Teachers

	Pre-Awareness	Awareness	Mastery	Advanced
Pre-Assessment	20	46	31	15
Post-Assessment	15	36	32	29

The post-assessment numbers indicate a decrease at the pre-awareness level and a large increase at the advanced level. Overall, the data showed that the cooperating teachers moved away from the pre-awareness level and toward the advanced level.

Teacher Candidates. A paired t-test was run for the seven teacher candidates who completed the CAQ. There was no significant difference between the pre and post CAQ assessments for each item. Table 3 indicates the total pre-assessment and post-assessment scores for each teacher candidate.

Table 3. Analysis of the Pre and Post CAQ Assessments for Teacher Candidates

Teacher Candidates	1	2	3	4	5	6	7
Pre-Assessment	109	111	118	132	109	119	121
Post-Assessment	113	111	116	130	115	125	117

The numbers indicate that three teacher candidates' attitudes improved, one stayed the same, and three declined. Given that the highest possible score is a 360 and the lowest possible score is a 72, teacher candidates' scores indicate that they continue to be negative toward using computers.

Evaluative Reports

A nine-question, administrator-created exit survey was administered to all participants to elicit their assessment of their experience in this project. Examples of questions included, "What technology skills did you learn as a result of your involvement with the Link-to-Learn grant?" "How has your perspective about using technology for teaching changed as a result of your involvement in the grant?" "What mentoring, modeling, or coaching practices (involvement with Technology Learning Specialist) did you find most beneficial as a result of your involvement in the grant?" Participants took this survey during their last meeting at the end of the project. Table 4 (following page) provides the frequency of responses for common themes that emerged for each question.

Highlights of findings for each question follow:

1. Faculty were focused on learning the basics, cooperating teachers were focused on more advanced technology such as digital media, and teacher candidates were focused on learning both (Question #1).
2. Faculty included additional assignments for their teacher candidates, but they themselves did not use it. Cooperating teachers and teacher candidates implemented technology in their own classrooms, and teacher candidates reported increased familiarity with available technology resources (Question #2).
3. Faculty and teacher candidates became increasingly convinced of technology's value, teacher candidates saw themselves as more able to see new uses for technology, and cooperating teachers saw themselves as more willing to take risks with technology (Question #3).
4. Faculty, cooperating teachers, and teacher candidates saw their respective students as becoming more familiar and comfortable with technology (Question #4).
5. All three groups of stakeholders benefited from the training and personal attention in learning new skills. Teacher candidates, in particular, saw the benefit of the Technology Learning Specialist (Question #5).
6. Faculty, cooperating teachers, and teacher candidates benefited from learning more about technology. Cooperating teachers were particularly appreciative of access to technology, and teacher candidates perceived themselves as having increased comfort and self-confidence in using technology (Question #6).
7. Faculty did not focus on any one particular strength of the grant. Cooperating teachers focused on personally benefiting from having access to the technology skills of student teachers and technology access and support. Teacher candidates responded that the strength of the grant was the technology support, training, and access (Question #7).
8. Faculty saw time, effort, and reluctance as weaknesses in the grant's implementation, whereas the cooperating teachers and the teacher candidates focused on the demands placed on student teachers. Teacher candidates also cited early confusion over the required grant assignments (Question #8).
9. Faculty want more time to develop technology skills in the future. Cooperating teachers want more preparation and time for student teachers, and teacher candidates want fewer lesson requirements and more prior training (Question #9).

Teacher Candidates' Use of Technology in Student Teaching

All seven student teachers created eight technology-based lessons, as indicated by the university supervisors' completion of the checklist created specifically for this project. Five of the seven student teachers completed their portfolios as required. A minimum of two lessons had to be included in the portfolio. Table 5 shows the type of technology used in the lessons provided, with some lessons using more than one type of technology. As the table indicates, educational software and the Internet were the most prevalent uses of technology.

Discussion

Faculty and Cooperating Teachers

The Mankato Scale indicated that the faculty began to move away from the pre-awareness level and more toward the awareness level, indicating some positive changes in their perceptions about their skills with technology. The cooperating teachers, who perceived themselves as having more awareness than faculty during the pre-assessment, showed increased movement toward the advanced level.

The evaluative report confirms the cooperating teachers' growth in using technology themselves and in using more advanced forms of technology such as digital media. This report also indicates the labored growth of the faculty in using technology themselves. Although they began to incorporate technology into their syllabi, they saw it as more of responsibility for students than for themselves. They became more aware of the value of technology, yet commented on the need for additional time to become more comfortable in using it.

Table 4. Exit Survey Results

Question	Reponses	Faculty/ Supervisors (n=7)	Cooperating Teachers (n=7)	Teacher Candidates (n=7)
#1 Technology Skills Learned	Use of software for teaching	4	1	5
	Webquests	1		
	How to create a Web page	3		1
	Advanced searching	3		2
	Conducting online discussion	1		
	Use of digital media	2	7	6
	Power Point presentations	1		2
#2 Changes made as a result	Technology requirements/assignments added to syllabi	7		
	More frequent use of tech for teaching children		5	5
	Greater familiarity with Web sites and tech for teaching	1	1	6
	More risk taking/willingness to try new technologies	1	1	1
#3 Changed perspective	More convinced of value/benefits of tech	6	2	4
	More likely to use tech	3		3
	Ability to see new uses for tech across curricula	1	1	6
	More willing to take risks with tech use		3	
	No change		1	
#4 How students benefited	Increased comfort, better prepared, more likely to use and find tech resources	8	7	7
	Discovered new, cooperative ways of learning and individualizing instruction	2	5	3
#5 Most beneficial training aspect	Flexibility & personal attention of TLS	3	3	6
	Student pride in tech use	1		
	New tech skills		4	2
	Collaborative team efforts	1	1	1
	Tech lab workshops & practice	2		4
#6 How you benefited	Greater awareness/learning of use of tech to improve teaching	7	3	7
	Ability to provide skills to students	2		
	Increased access to technology makes use more likely		4	1
	Increased comfort level and confidence in tech use	1	1	7
#7 Strengths of Grant	Group dynamics & teamwork	2	1	
	Student engagement with tech	2		
	Tech requirements in methods courses	2		
	Tech support, training, & access	2	6	7
	Skills of student teachers & transfer to cooperating teachers	1	5	
#8 Weaknesses of Grant	Extra time & effort required at expense of regular lessons	2	1	
	Early confusion & lack of clear requirements	3	3	6
	Own reluctance to learn/use tech	1		
	Too many lessons, candidates had too much to learn during student teaching; more prior training of teacher candidates needed	2	4	7
	Competition for labs & equipment		3	2
#9 Future Suggestions	More time to take advantage of tech & develop skills	3	3	3
	Release time to learn to use tech	1		
	Continued tech support of TLS	1	2	
	Fewer lesson requirements (stress)	1	4	5
	More prior training for candidates	1	2	6
	Improved equipment maintenance		2	1

Table 5. Student Teachers' Use of Technology

Type of Technology	Use	#	Subject Areas
Educational Software	Organize and analyze data, word processing, presenting data, reinforcement/drill	18	6 for language arts 3 for mathematics 5 for science 4 for social studies
Internet	Student research	12	Social studies, language arts, and science
Digital Camera	Create slide show for class review and quiz	1	Science

Teacher Candidates

Although the CAQ did not indicate significant changes in student teachers' attitudes toward using technology, and their attitudes were still negative, they did in fact use it as required. Every student teacher developed and taught eight technology-based lessons. The technology primarily used in these lessons were educational software and the Internet. The evaluative report indicates that the teacher candidates responded to the project more like the cooperating teachers than the faculty. They learned both basic and advanced forms of technology, became more comfortable and confident with their use, and were more aware of the benefits of using technology for teaching. They appreciated the training, support, and personal attention from the Technology Learning Specialist, and while they desired to have fewer lesson requirements and more prior training, they did learn how to use technology to improve their teaching. Their comments are not consistent with the results of the CAQ, and indicate a more positive attitude toward using technology.

The focus of this article, however, is not so much about the changes in stakeholders' behavior as it is about the issues that often are not anticipated or are overlooked by project directors in favor of highlighting successes.

Issues with Implementing the Grant

We discovered that implementation of this yearlong grant was much more complicated than originally anticipated. Out of necessity, the proposed one-person director for the grant evolved into an administrative triad that was involved at both the university and school district levels. Along with oversight issues, there were issues with practically every aspect and phase of the grant and, most significantly, with the stakeholders.

University Faculty

Two major issues surfaced with the university faculty. Faculty reluctance became obvious from the outset. Although they had agreed to participate initially, they really did not understand the extent of their responsibilities. In truth, neither did we. Although the TLS was available to help them revise their syllabi, they did not avail themselves of this resource. Contributing to this problem was their status at the university. Either they were new to the university and afraid to say no, or were veterans and did not feel the need to change. The honorarium faculty received for their participation did not buy the enthusiasm that we had hoped.

To get the faculty started, we held frequent meetings as a group so they could review and report changes in the syllabi. We offered one-on-one tutoring in their offices and assistance during teaching time by the TLS, and developed forms and rubrics for them to use in their coursework (e.g., rubrics for software and Web site evaluation, Web-based lessons, and technology projects). The TLS was available to teach technology skills and provide oversight of their assignments as needed.

The second major issue was faculty lack of technology prowess. Two faculty came to this grant with anxiety about using computers, which became apparent in the pre-assessment survey and their comments. In fact, most of the faculty did not really have any skills beyond word processing and e-mail; the two essential skills for functioning in any university setting.

To help the faculty, the TLS prepared Professional Improvement Plans that targeted their specific needs and interests. He then scheduled workshops and one-on-one tutoring for them to achieve their goals. In the beginning, and because the TLS was focused solely on working with university faculty and students on campus, he was able to give the faculty as much assistance as requested. However, toward the end of the year, and because he was more involved in the school, the university faculty did not have continued access to the modeling and mentoring they needed to progress to higher stages of development. These circumstances probably contributed to their lack of significant change over the course of the project.

The Professional Development School (PDS)

Because the university has had a long, positive history with the PDS, and because the school district's mission is to be technologically savvy, we anticipated that the cooperating teachers would be ready for the project. Further, because the cooperating teachers were receiving two wireless labs for use in their classrooms, there was much more enthusiasm about the project among them. We quickly discovered, however, that there was a wide range of technology skills among the cooperating teachers, as shown in Table 1. Some teachers already had a master's degree in technology and served as role models for other teachers in the school, while others were extremely intimidated by the thought of technology, mostly because of the lack of equipment and their lack of experience in using the equipment.

The cooperating teachers did not have all of the technology skills we expected, and it became clear that about half of them were not ready to mentor their student teachers in the use of technology. Technical support, while supposedly plentiful, turned out to be a classroom teacher who had to be relieved of her own classroom responsibilities before she could assist another teacher. Although this person was more than willing to help a teacher in need, she could not always be available on short notice.

Hardware and software issues became a major obstacle. There were unexpected technical problems with installing and managing network software. The carts were hard to move and cumbersome. Software often had to be installed, and the cooperating teachers did not know how to do it. The Internet would get bogged down, and consequently, they could not access a site. The "Plan B" phenomenon had to be activated, which evoked a great deal of resentment among veteran teachers.

The TLS spent three-fourths of his week at the school site during the spring semester. He provided in-class support to the student teachers and the cooperating teachers, technical support for hardware and software issues, and workshops on topics such as Web site development, multimedia development, and digital video and digital photography. To further alleviate some of the cooperating teachers' anxiety, we met with them on a biweekly basis to address their concerns. Meetings were held after school so that they did not have to travel or disrupt their school day, and were brief enough so that they did not create any inconvenience to their daily schedules. The principal also let the cooperating teachers change their teaching schedules to facilitate sharing of the wireless labs.

The biggest challenge since the grant ended has been our ability to sustain the project in the PDS, even though the school now possesses two additional wireless labs. Although all cooperating teachers came to enjoy using technology in their teaching, only one-third want to have student teachers every semester. As told to us, the cooperating teachers felt drained from the responsibility of mentoring student teachers and integrating technology into their own teaching. Many adjustments to their routines had to be made (e.g., reorganizing their classroom schedules, making arrangements for the wireless labs, and revising lessons to include technology). The cooperating teachers also expressed concern about preparing their own students for high-stakes testing. Although we have had conversations with the principal about this situation, we have had to come to understand cooperating teachers' competing pressures, and accept this as a condition of the program.

Even with these issues, we are finding that the cooperating teachers without student teachers, once resistant to using technology, are using it as frequently as possible. In fact, the cooperating teachers without student teachers often compete with the cooperating teacher/student teacher teams for use of the wireless labs. This situation has had to be resolved by giving the cooperating teacher/student teacher teams first priority.

Another post-grant issue has been the lack of communication about institutional responsibilities and ongoing technical support. Members of the PDS assumed that our university would be forever responsible for ordering missing and broken parts, and for providing technical support.

We thought that the district would assume responsibility once the grant ended. Again, a discussion had to occur to resolve this issue.

Teacher Candidates

The seven students selected to participate as student teachers during the spring semester were chosen because of favorable faculty recommendations and high grade point averages. It was expected that the student teachers would have acquired the necessary skills to use technology from their four key methodology courses taken during the fall semester. Unfortunately, and as shared in the opening story of Melissa, the student teachers did not have the necessary skills. They did not know how to use a portable computer, search the Internet for educational sites, develop multimedia, create Web pages, or evaluate software for their teaching. Above all, they did not understand what it meant to develop and teach a lesson with technology.

Although initially enthusiastic about being selected to participate, they panicked when they realized what was required of them in 14 short weeks. They banded together, identified a spokesperson, and quickly called the three of us to ask for immediate help. Their recognition of their lack of knowledge and skills, and their quick response, actually saved the project, because they helped us to see what we needed to do to get them functioning with technology.

To help the teacher candidates, we met with them at the PDS, listened to their concerns, identified their problem areas, and determined a course of action. We set up a weekly workshop schedule for them with the TLS in our lab. We helped the TLS establish a consistent schedule of meeting times with the student teachers that included one-on-one tutoring, software and Web site demonstrations, and in-class mentoring. We continued to meet with the student teachers weekly until they let us know that they no longer needed administrative support. By the end of the semester, the student teachers were able to create, as a collaborative team, a multimedia presentation about their experiences and technology accomplishments.

The Technology Learning Specialist (TLS)

Out of a field of more than 20 candidates, we hired a retired teacher from a large, metropolitan school district who had served as a classroom teacher and technology specialist for his school. There was an expectation that this person, who was hired with superb credentials, would be able to do all the necessary training, modeling, and mentoring. We quickly came to realize that too many conflicting expectations were placed upon this one person, and that he was being pulled in too many directions to be effective. We had to spend a great deal of time reinforcing, readjusting, and redefining the role of the TLS.

We included him in all stakeholders' meetings so that he learned firsthand the most pressing challenges and instructional needs. Rather than be available to serve at will, we had him create a schedule of workshops and open lab sessions so that all three groups of stakeholders knew when certain topics would be covered. One of us developed a tracking system with him to be able to get in touch with him immediately about emergency situations.

Because his strength is with technology integration rather than with administrative tasks, we had the graduate assistant assigned to the project work with him to create lab schedules, student databases, and software and hardware databases. The graduate assistant also made herself available during open lab times and student workshops.

During the spring semester, we further redefined and streamlined his position so that his primary responsibilities were in the school, supporting the student teachers, cooperating teachers, and university supervisors. We created a schedule that placed him in the school for a minimum of three days a week so that he was readily available for individual mentoring and technical assistance in the student teachers' classrooms.

Accessibility to Equipment

Although we thought that we had purchased sufficient equipment, we soon discovered that the student teachers needed to have computers for home use that were compatible with the wireless labs in the schools. They also needed these computers to prepare their lessons and work on their required electronic portfolios. The Project Director had to purchase six additional laptops for use by the student teachers.

Although this seems as if it would be an easily resolvable task, it actually became a big issue because of timing. The Project Director did not discover this problem until midway through the student teaching semester. The student teachers were already drowning in stress from their lack of accessibility to like technology. To survive the demands of the semester, they were taking home the portables from the carts, and leaving the carts without the full complement of workstations. This created a hardship in the classroom for most of the planned lessons.

Moreover, because the portables were Macintoshes, and most student teachers had experience primarily with Windows, they were not comfortable moving back and forth between the two platforms. The student teachers needed assistance in learning some of the differences with the Macintosh platform.

Outcomes and Lessons Learned

As our story of Melissa indicates, and our findings show, there were many positive outcomes. And, as described above, there were administrative challenges that made us aware of the difficulties in demanding technology integration in teacher education programs. We describe the outcomes and lessons learned from the university faculty, cooperating teachers, student teachers, and TLS.

University Faculty

Although the university faculty did not fully embrace technology, they did begin to incorporate technology into their methodology courses. They became more aware of their own technology needs and of what they should be doing with teacher candidates. University supervisors became much more aware of the importance of their role as critical stakeholders in the process. They also grew in their understanding of ways in which technology can enrich teaching.

First Lesson Learned: In order to effect change with students, you need to effect change with faculty. Many faculty simply comply minimally and unenthusiastically with what is expected of them. What starts out as curiosity ends up being lip service because of the unanticipated expectations that truly affect their workload. One faculty member reflected about the required changes as follows:

> "It was a very time consuming process for me to sift through my traditional course content to decide what to give up to make space for new material, what assignments to eliminate to create new ones, and how to plan for assessment and grading of these new assignments." (Wepner, Tao, & Ziomek, 2004).

This particular faculty member happened to be motivated to use technology. Others with less enthusiasm were not willing to put in the time that she did to transform a course because of its distraction from other faculty responsibilities. As another faculty member wrote in her journal, "I felt stressed for time to cover all material (content) and add use of technology." Faculty often saw technology as an extra burden and an extra topic to teach rather than a means of teaching and enriching content. Thus, the availability of technical assistance and additional funds for participation simply were not enough to motivate faculty with this mindset.

In hindsight, we discovered that we were too focused on student outcomes, and not focused enough on faculty outcomes. We assumed that

faculty would be self-motivated to change the way they taught because of the incentives provided. However, some faculty members were truly resistant to the idea. Next time, we would concentrate on providing more guidance to faculty on possible ways that technology can be used to improve their teaching. With faculty willingness, a Technology Learning Specialist-type would be assigned to faculty to "sift" through their coursework to identify ways to restructure their courses, would be available to model the use of technology in actual classrooms, and would return frequently to faculty classrooms to give support until faculty members were confident with their own skills.

Cooperating Teachers

The cooperating teachers in the PDS benefited by acquiring two wireless labs that they could use. Before that, the cooperating teachers had outdated equipment that did not allow them to connect with the Internet. The technology that they used was primarily textbook-based software that reinforced concepts from specific mathematics or reading series. The cooperating teachers also had access to the TLS to assist with lab set-up, software installation, training, troubleshooting, and Web site identification. The cooperating teachers actually looked to the University's TLS as their school-based technical specialist. The grant enabled the cooperating teachers to fulfill the technology requirements of their district, thereby contributing to the district's mission of being technologically savvy.

Second Lesson Learned: University administrators must be very specific about the support required from the school and the school district.

We were so anxious to get the school's blessing for grant application that we did not really specify expectations for cooperating teachers. We did not explain beforehand that they would be partially responsible for student teachers' completion of the technology requirements. We pitched this grant as an opportunity to acquire new technology that would stay in their school permanently in exchange for their oversight of student teachers' use of technology.

We mistakenly assumed that the cooperating teachers understood that they would continue to accept student teachers each semester because of their newly acquired equipment. We did not learn until after the grant ended that the cooperating teachers were not willing to do this. Although this has hurt our ability to sustain the momentum of the grant, we have had to accept this condition of placing fewer student teachers in the school.

Another mistaken assumption was that the school would maintain the equipment after it was placed there. Because we had not been specific about this responsibility, we ended up having to install software, troubleshoot, and handle maintenance until the grant ended. Although the principal and cooperating teachers expected us to continue this service beyond the grant, we have had to disappoint them because we do not have the funds or personnel to do this.

In the future, we will enumerate in writing expectations for grant participation. We will use a contract between the school district and the university that identifies specific obligations for each institution. We also will develop a governing board to provide oversight of the grant with the expectation that unanticipated issues will emerge. Language to this effect will be included in the contract.

Student Teachers

The student teachers benefited by having a competitive edge in the job market because of their technology-based artifacts (i.e., actual videos of their technology-based lessons and electronic portfolios). They learned about the benefit of teamwork that actually became their survival mechanism for implementing the technology requirements. The video that they developed to demonstrate ways in which they used technology across the curriculum was an unexpected outcome of their camaraderie.

Third Lesson Learned: Do not assume that student teachers have acquired the skills from prerequisite technology-infused courses.

Written into the grant was the requirement that teacher candidates would learn how to develop and implement technology-infused lessons in their content-specific methodology courses. We assumed that by the time teacher candidates began their student teaching semester, they would have acquired technology competencies such as Web page design, Internet-based instruction, and software integration. These competencies should have enabled them to develop and teach eight technology-based lessons across four content areas. But, we assumed incorrectly. First, half of the student teachers did not have access to the newly designed methodology courses. Second, even if they were enrolled in these courses, they did not necessarily acquire all the skills needed to succeed with technology during student teaching because the content-specific methodology courses (reading/language arts, mathematics, science, and social studies) could not be revised significantly enough by the faculty during the grant period to include specific technology applications. Third, we did not monitor student teachers beforehand and learned too late about their lack of technology competence and confidence.

Next time, we will use different criteria for selecting student teachers, insuring that they have a modicum of technology skills for success. We also will interact sooner with them so that they can prepare earlier and better for their assignments.

Technology Learning Specialist (TLS)

The TLS was vital to the grant's success. His training, mentoring, and troubleshooting enabled the student teachers to meet all required competencies, despite their lack of adequate preparation. He taught the cooperating teachers how to use technology, and he got the faculty started on revising their syllabi. He was the link between the school and the university.

Fourth Lesson Learned: Craft job descriptions of personnel to be hired with very specific and doable responsibilities and expectations.

Our vision for the role of the TLS did not match the realities of the requirements. Next time, we will seek out the advice of other, more experienced faculty and administrators from other universities who already have grappled with the hiring of personnel for technology positions. We will then compare their situations to ours to develop more reasonable job responsibilities. Now that we now have our own firsthand experience with a person in such a position, we will use his feedback to help us reconceptualize what is feasible with the tasks to be accomplished.

Conclusions

Despite a host of challenges, this grant provided unprecedented opportunities to learn about and use technology. With the acquisition of new equipment and the hiring of a new staff person, Technology^3 continues as a special initiative for infusing technology into the undergraduate elementary education program. Faculty meet two times each semester to discuss what they continue to do with technology, and what they would like to see change in the program. Three one-credit technology courses were created as co-requisites for the key methodology courses. In the first of the new courses, teacher candidates learn Web page design and how to teach with Internet-based tools. In the second course, teacher candidates learn how to design and integrate multimedia projects into their teaching. The third course prepares teacher candidates to develop technology-based lessons across the curriculum. These three one-credit courses are paired with methodology courses so that teacher candidates are required to use the technology they are learning in their content-based assignments.

A Technology Committee has been formed to identify specific competencies needed to expand the project to include all teacher candidates. Again, although we have enthusiasm for our newfound technology goals, we now are realistic enough to know that we will encounter resistance, anxiety, equipment malfunctions and obsolescence, maintenance problems, and overwhelming electronic and personnel predicaments.

References

Anderson, C. L., & Petch-Hogan, B. (2001). The impact of technology use in special education field experience on preservice teachers' perceived technology expertise. *Journal of Special Education Technology, 16*(3). Retrieved October 14, 2003 from http://jset.unlv.edu/16.3/anderson/first.html.

Brush, T., Glazewski, K., Rutowski, K., Berg, K., Stromfors, C., Hernandez Van-Nest, M., Stock, L., & Sutton, J. (2003). Integrating technology in a field-based teacher training program: The PT3@ASU Project. *Educational Technology Research and Development, 51*(1), 57–72.

Dawson, K., & Norris, A. (2000). Preservice teachers' experiences in a K–12/university technology-based field initiative: Benefits, facilitators, constraints, and implications for teacher educators. *Journal of Computing in Teacher Education, 17*(1), 4–12.

Faison, C. (1996). Modeling instructional technology use in teacher preparation: Why we can't wait. *Educational Technology, 36*(5), 57–59.

Handler, M. G. (1993). Preparing new teachers to use computer technology: Perceptions and suggestions for teacher educators. *Computers and Education, 20*, 147–156.

Haney, A. (1997). The role of mentorship in the workshop. In M.C. Taylor (Ed.), *Workplace education* (pp. 211–228). Toronto, Ontario: Culture Concepts.

Johnson, D. (1999). *The indispensable teacher's guide to computer skills: A staff development guide.* Worthington, OH: Linworth Publishing.

Johnson-Gentile, K., Lonberger, R., Parana, J., & West, A. (2000). Preparing preservice teachers for the technological classroom: A school-college partnership. *Journal of Technology and Teacher Education, 8*, 97–109.

Knezek, G., & Christensen, R. (1998, March). *Internal consistency reliability for the teachers' attitudes toward information technology questionnaire.* Paper presented at the Annual Meeting of the Society of Information Technology & Teacher Education (SITE)'s Ninth International Conference, Washington, DC.

Kovalchick, A. (1997). Technology portfolios as instructional strategy: Designing a reflexive approach to preservice technology training. *TechTrends, 42*(9), 31–36.

Lan, J. (2001). Web-based instruction for education faculty: A needs assessment. *Journal of Research on Computing and Education, 33*(4), 385–399.

Marcovitz, D. A. (1999). Support for information technology in schools: The roles of student teachers. *The Journal of Information Technology for Teacher Education, 8*(3), 361–374.

Marra, R. M., Howland, J., Wedman, J., & Diggs, L. (2003). A little TLC (Technology Learning Cycle) as a means to technology integration. *TechTrends, 47*(2), 15–19.

McCoy, L. P. (2000, April). *Computer skills and instructional activities of student teachers and cooperating teachers.* Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA.

Milbrath, Y-C., & Kinzie, M. B. (2000). Computer technology training for prospective teachers: Computer attitudes and perceived self-efficacy. *Journal of Technology and Teacher Education, 8*,373–396.

Morrow, L. M., Barnhart, S., & Rooyakkers, D. (2002). Integrating technology with the teaching of an early literacy course. *The Reading Teacher, 56*(3), 218–230.

Nicaise, M., & Barnes, D. (1996). The union of technology, constructivism, and teacher education. *Journal of Teacher Education, 47*, 205–212.

Pope, M., Hare, D., & Howard, E. (2002). Technology integration: Closing the gap between what preservice teachers are taught to do and what they can do. *Journal of Technology and Teacher Education, 10*, 191–203.

Ross, T.W., & Wissman, J. R. (2001). Resdesigning undergraduate technology instruction: One college of education's experience. *Journal of Technology and Teacher Education, 9*, 231–244.

Ryan, D., Onarheim, K., & Anderson, C. L. (2001). A partnership for training teachers: Using technology-rich cohorts. *Proceedings of Society for Information Technology and Teacher Education (SITE), 2001*(1), 1916–1918.

Sheehy, E. J. (2001). *Student teacher mentoring program: Teacher training for information literacy in the classroom.* Unpublished doctoral dissertation. State University of New York at Albany.

Strudler, N., & Wetzel, K. (1999). Lessons from exemplary colleges of education: Factors affecting technology integration in preservice programs. *Educational Technology Research and Development, 47*(4), 63–81.

Suleiman, M. (2001). *Technology and teacher preparation: Towards a humanistic framework.* (ERIC Document Reproduction Service No. ED 454 221)

Vannatta, R. A., & Beyerbach, B. (2000). Facilitating a constructivist vision of technology integration among education faculty and preservice teachers. *Journal of Research on Computing in Education, 33*(2), 132–148.

Wang, Y-M. (2002). When technology meets beliefs: Preservice teachers? Perception of the teacher's role in the classroom with computers. *Journal of Research on Technology in Education, 35*(1), 150–161. Retrieved September 8, 2003 from http://firstsearch.oclc.org/images/WSPL/wsppdf1/HTML/07424/W6UMN/XFY.HTM.

Wepner, S. B., Tao, L., & Ziomek, N. (2003, Winter). Three teacher educators' perspectives about the shifting responsibilities of infusing technology into the curriculum. *Action in Teacher Education, 24*(4), 53–63.

Wepner, S. B., Tao, L., & Ziomek, N. (2004). *Three teacher educators' experiences with shifting responsibilities and contextual complexities in developing proficiencies to use technology.* Manuscript submitted for publication.

Yildirim, S. (2000). Effects of an educational computing course on preservice and inservice teachers: A discussion and analysis of attitudes and use. *Journal of Research on Computing in Education, 32*(4), 479–495.

Young, J. R. (2002, February 22). Ever so slowly, colleges start to count work with technology in tenure decisions. *The Chronicle of Higher Education.* Retrieved July 19, 2002 from http://chronicle.com/weekly/v48/i24/24a02501.htm.

Zambo, R., Buss, R., & Wetzel, K. (2001). Technology integration in K-12 classrooms: Evaluating teachers' dispositions, knowledge, and ability. *Proceedings of Society for Information Technology and Teacher Education (SITE). 2001*(1), 2165–2169.

Zehr, M. (1997). Training the teachers. *Education Week.* Retrieved October 10, 2003 from http://www.edweek.org/sreports/tc/teach/ten.htm.

Shelley B. Wepner is a professor and Dean of the School of Education, Manhattanville College, Purchase, New York. Her research interests include ways to help teachers and teacher educators use technology, connections between K–12 education and higher education, and leadership skills for effectively supporting literacy development and teacher education. She is the author/coauthor of three award-winning software packages for elementary and adolescent literacy development, and was the chair of the Technology in Teacher Education Committee of the American Association of Colleges for Teacher Education, 2001–2003. She recently completed a project that suggests a broader view of technology integration for teacher educators.

Shelley B. Wepner
Professor and Dean
School of Education
Manhattanville College
2900 Purchase Street
Purchase, NY 10577
Phone: 914.323.5192
wepners@mville.edu

Kathleen A. Bowes is an assistant professor, program coordinator for MEd and doctorate in Instructional Technology, and technology coordinator for the Center for Education at Widener University in Chester, Pennsylvania. She has been actively involved in all aspects of instructional technology at both the school district and university levels. Additional university responsibilities include staff development, software and hardware acquisition, and technology-curriculum integration. Her research interests focus on technology integration and assessment for both preservice and inservice teachers, development and evaluation of hybrid distance learning courses, and assistive technology in preservice education.

Katheleen A. Bowes
Assistant Professor
School of Human Service Professions—Center for Education
Widener University
One University Place
Chester, PA 19013
Phone: 610.499.4256
kathleen.a.bowes@widener.edu

Rita S. Serotkin is assistant director of the Center for Education, Widener University, Chester, Pennsylvania. Prior to joining Widener University, she coordinated and developed noncredit adult and youth programs and worked with faculty at a community college to help them integrate and develop electronic learning materials and resources for instruction. She is in charge of the Web site for the Center for Education. Her current research interests include ways to help teachers, teacher candidates, and teacher educators use technology effectively, marketing and recruitment in higher education, career change, and second-career teachers.

Rita Serotkin
Assistant Director
School of Human Service Professions—Center for Education
Widener University
One University Place
Chester, PA 19013
Phone: 610.499.4490
rita.s.serotkin@widener.edu